REMARKS

Claims 1-4 are pending in this application.

35 U.S.C. § 103 Rejections

Claims 1 and 2 stand rejected under 35 U.S.C. 103(a) as allegedly being obvious over United States Patent No. 3,975,267 to Wendel (hereinafter "Wendel") in view of United States Patent No. 5,393,416 to Kozak et al. (hereinafter "Kozak"), and further in view of United States Patent No. 6,340,712 to Kunin et al. (hereinafter "Kunin"). The Examiner suggests that it would have been obvious to rinse the resin of Wendel according to the teaching of Kozak followed by regeneration with the ultra-pure water according to Kunin. Applicants respectfully disagree.

The present invention is directed to a method of regenerating an ion exchange resin consisting of the steps of:

packing a used ion exchange resin in a regeneration tower; and

sequentially repeating, at least twice, a step that includes passing an aqueous solution of regenerant through the regeneration tower downward from a top part of the regeneration tower and thereafter passing ultra-pure water through the regeneration tower upward from a bottom of the regeneration tower.

Wendel discloses a method of producing treated liquids by using an ion exchange resin. The liquid to be treated is passed through a zone containing the ion exchange resin. When the ion treating resin is exhausted, it is regenerated by passing therethrough a liquid regeneration solution (in a direction opposite of the flow of liquid to be treated). The regeneration solution is added in increasingly concentrated amounts in at least two steps and preferably three steps or more.

Kozak discloses an automated system for providing at least periodic removal of metal ions from a chemical complex and contaminants from a chemical bath. The chemical bath is passed through an ion exchange resin column at a low velocity to prevent coagulation of latex particles.

Kunin discloses non-chloride containing regenerant compositions that include potassium acetate or potassium formate, at least one surfactant and at least one chelating agent, as well as methods for efficient regeneration of water softeners utilizing the regenerant compositions.

At col. 4, lines 5-10, Wendel states:

> In the present invention, after the treating resin is exhausted the resin is backwashed or pre-rinsed to cleanse the resin by mechanical action and to reclassify the resin particles by weight and size; the finer particles remaining at the upper part of the bed and the heavier particles at the bottom of the bed.

Thus Wendel indicates that the treatment merely eliminates particulate impurities based on differences in weight and size. However, the regeneration method according to the present invention is not concerned with this type of treatment.

At col. 4, lines 22-26, Wendel states:

> After the treating resins, i.e. the ion exchange resins and the adsorbent resins, have been regenerated the treating materials are rinsed, generally with water if that is the liquid to be treated, in order to remove the regeneration liquid.

This step describes a rinse treatment, which is applied after the regeneration treatment.

At col. 4, lines 27-33, Wendel states:

> As noted hereinbefore, the critical aspects of the present invention reside in employment of pressurization during service, regeneration and rinsing as well as utilizing multiple step regeneration and counter flow regeneration. That is, up flow regeneration and down flow service or, in the alternative, down flow regeneration and up flow service.

Wendel describes that "up-flow" or "down-flow" refers to the direction of both regeneration and services. Wendel, however, does not explain which type of flow is selected for use in each individual step, and fails to even disclose such flow directions for rinsing. Further, Wendel does not disclose or even suggest the specific flow direction as in the claimed invention, where the regenerant is passed downwardly and the rinsing water is then passed upwardly, let alone sequentially repeating this reverse flow regeneration and rinsing.

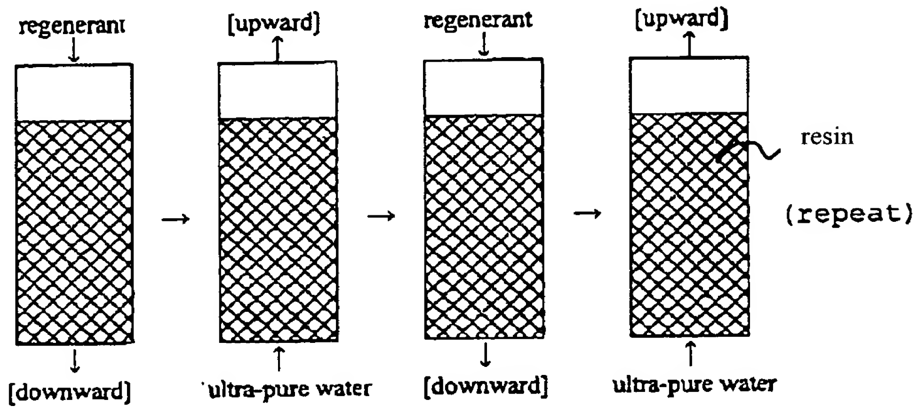
Moreover, at col. 4, lines 49-55, Wendel states:

> Pressurization, in combination with step wise regeneration, reduces resin expansion and provides full and complete contact of regeneration liquids with ion exchange or adsorbent resin materials and permits full penetration of regenerant to the center of the resin beads as well as allowing for almost complete use of the regeneration liquid.

This treatment described by Wendel is used merely to prevent resin expansion. The regeneration method for ion exchange resins according to the presently claimed invention does not include this treatment.

As outlined above, Wendel discloses a widely known method, but does not disclose the specific sequence for the flow of regenerant and pure water as in the presently claimed invention.

The regeneration tower of the present invention is shown as follows:



The regenerant is one or the other of an acid or base compound appropriate to the ion exchange resin used in the present invention. In the operation of the ion exchange resin as described above, channeling of the regenerant as it passes through the ion exchange resin is generally avoided. Even if channeling occurs in a layer of the ion exchange resin, the channeling effect is broken, preventing the occurrence of non-uniform regeneration. This allows the ion exchange resin to be regenerated efficiently and homogeneously, resulting in no non-uniform regeneration. Further, the internal part of the ion exchange resin can be washed.

Additionally, in the present invention, the regeneration of the ion exchange resin is carried out through the use of an ion exchange resin tower (regeneration tower), and the claims include a specific step of packing the used resin in a regeneration tower. This regeneration tower is different from the purifier towers in the methods disclosed in the cited prior art. In the present method, mixing of the regenerant into the purifier towers can be avoided. Thus, in the present invention, there is no need to interrupt the purification of an aqueous hydrogen peroxide solution.

Wendel merely discloses a widely known process for regeneration of an exhausted ion exchange resin. Further, Wendel describes at col. 6, lines 56-61 and col. 7, lines 8-15 the following.

> In the step wise regeneration of the cation exchange resin utilizing an acid solution, there must be 2 and preferably at least 3 or more separate steps starting with a concentration of at least 0.5% and ranging upwards to the maximum concentration which the particular cation resin can use...
>
> The caustic or sodium hydroxide regeneration of the anion exchange resin is conducted in at least 2 and preferably at least 3 or more steps. As a general rule, the initial concentration of the aqueous solution of sodium hydroxide will vary from 0.5% to 2% and thereafter the concentration can be raised with the final percentage generally depending upon the maximum solution allowed for the particular anion resin.

In other words, the cation exchange resin is converted to a Na-type resin.

It is known that the spent ion exchange resin is generally regenerated by a regenerant. For example, an anion exchange resin can be regenerated by packing the anion exchange resin in a tower and sequentially passing an alkali aqueous solution, an acid aqueous solution, and once more an alkali aqueous solution through the anion exchange resin tower. In other words, both alkali and acid are used as regenerant.

For resins regenerated by the method described above, a regenerant, such as NaOH or HCl, may remain in the ion exchange resin. This residual regenerant may act to prevent or retard the satisfactory removal of ionic impurities from an aqueous hydrogen peroxide solution. Further, in this conventional method, channels are formed ("channeling") through which much of the regenerant passes. Channeling leads to non-

uniform contact between the regenerant and the ion exchange resin, which results in an ion exchange resin that is not homogeneously regenerated.

In the present invention, alkali materials such as NaOH and acid material such as HCl are not used as regenerants. Therefore, the potential for such materials to act as ionic impurities can be eliminated. By contrast, Wendel only discloses a widely known process for regenerating exhausted ion exchange resins, and does not disclose the presently claimed process or in any way suggest the benefits of or provide motivation towards the present process.

Kozak discloses the following in column 17, lines 19 to 29:

> Mode VI-B is provided via controller 127 for rinsing IEX column 29 in an upflow direction 8 with DI water, and discharging the rinse water from the system for waste treatment. This upflow flushing operation is performed at a predetermined velocity for the flow of DI water to fluidize the ion exchange resin 30 in the IEX column 29, for ***substantially removing foreign particulate material*** from IEX column 29. In this manner, plugging of the IEX column 29 by the buildup of the foreign particulate material over a number of subsequent cycles of operation is prevented. (emphasis added)

In other words, the above-mentioned method disclosed in Kozak is carried out <u>to separate or to remove foreign particles from an ion exchange resin column based on the differences in their respective weight or density</u>. The method of Kozak is different from the regeneration of an ion exchange resin. Kozak does not show that an ion-exchange resin is regenerated by the regenerant.

Kunin discloses a non-chloride containing regenerant composition and method for regenerating water softeners. In Kunin, ultra-pure water is used in rinsing the resin bed. However, Kunin never includes the repeated downward application of an

aqueous solution of regenerant and that ultra-pure water is applied, or the flow rates of either the aqueous solution of regenerant or the ultra-pure water, as in the present invention.

None of Wendel, Kozak and/or Kunin, taken alone or in combination, disclose, describe, teach or in any way motivate a skilled artisan to regenerate an ion exchange resin using only the steps of packing a used ion exchange resin in a regeneration tower, and sequentially repeating, at least twice, a step that includes passing an aqueous solution of regenerant through the regeneration tower downward from a top part of the regeneration tower and thereafter passing ultra-pure water through the regeneration tower upward from a bottom of the regeneration tower.

Therefore, claims 1 and 2 are not rendered obvious over Wendel in view of Kozak and/or Kunin. Applicants respectfully request withdrawal of the rejection and allowance of claims 1 and 2.

The Examiner has rejected claims 3 and 4 under 35 U.S.C. 103(a) as being obvious over Wendel in view of Kozak, and Kunin, and further in view of United States Patent No. 4,652,352 to Saieva (hereinafter "Saieva").

Wendel, Kozak, and Kunin are distinguished above. Saieva discloses a process and apparatus for recovering metals from dilute solution. Saieva discloses a closed loop process and apparatus whereby metals may be recovered from spent electroplating rinse solutions for reuse in the electroplating bath with essentially no generation of waste. However, Saieva does not disclose how to regenerate the spent ion exchange resin. Furthermore, repeating the step twice of passing an aqueous solution of regenerant through the regeneration tower downward from a top part of the regeneration

tower and thereafter passing ultra-pure water through the regeneration tower upward from the bottom of the regeneration tower is not disclosed in Saieva.

Claims 3 and 4 indicate that the regeneration tower can be made of a fluororesin, a vinyl chloride resin or a polyolefin resin.

However, adding the disclosure of Saieva to that of Wendel, Kozak and/or Kunin, taken alone or in any combination, does not bridge the gap to lead one skilled in the art to the present invention. The combined disclosure still fails to describe, teach or in any way motivate a skilled artisan to regenerate an ion exchange resin using only the steps of packing a used ion exchange resin in a regeneration tower, and sequentially repeating, at least twice, a step that includes passing an aqueous solution of regenerant through the regeneration tower downward from a top part of the regeneration tower and thereafter passing ultra-pure water through the regeneration tower upward from a bottom of the regeneration tower.

In the present invention, even if channeling is generated in a layer of ion exchange resin, the channeling is broken with the result that, without the occurrence of non-uniform regeneration, the ion exchange resin can be regenerated efficiently and homogeneously. Further, the ion exchange resin can be washed within the tower. Still further, in the present invention, the regeneration of ion resin is carried out by the use of an ion exchange resin tower (regeneration tower) which is different from purifier towers. Therefore, the mixing of the regenerant in the purifier towers can be avoided, and it is not needed to interrupt the purification of aqueous hydrogen peroxide solution.

The combination of Wendel, Kozak, Kunin and Saieva does not render claims 3 and 4 obvious. Therefore, Applicants respectfully request that the rejection be withdrawn and that claims 3 and 4 be allowed.

CONCLUSION

In view of the foregoing remarks, it is believed that the present application is in condition for allowance. Reconsideration of the rejections and allowance of claims 1-4 are respectfully requested.

Respectfully submitted,

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